

US011624484B2

(12) **United States Patent**  
**Butler et al.**

(10) **Patent No.:** **US 11,624,484 B2**  
(45) **Date of Patent:** **Apr. 11, 2023**

(54) **FLASHLIGHT HAVING A REMOVABLE LIGHT HEAD**

(71) Applicant: **MILWAUKEE ELECTRIC TOOL CORPORATION**, Brookfield, WI (US)

(72) Inventors: **Daniel P. Butler**, Wauwatosa, WI (US); **Kevin R. Kirk**, Minnetonka, MN (US); **Jeffrey L. Spenner**, Germantown, WI (US); **Kevin D. White**, Milwaukee, WI (US)

(73) Assignee: **MILWAUKEE ELECTRIC TOOL CORPORATION**, Brookfield, WI (US)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **17/569,250**

(22) Filed: **Jan. 5, 2022**

(65) **Prior Publication Data**

US 2022/0214017 A1 Jul. 7, 2022

**Related U.S. Application Data**

(60) Provisional application No. 63/133,820, filed on Jan. 5, 2021.

(51) **Int. Cl.**  
**F21L 4/00** (2006.01)  
**F21V 14/06** (2006.01)  
(Continued)

(52) **U.S. Cl.**  
CPC ..... **F21L 4/005** (2013.01); **F21V 14/065** (2013.01); **F21V 17/002** (2013.01); **F21V 17/14** (2013.01); **F21V 31/005** (2013.01)

(58) **Field of Classification Search**  
CPC ... **F21L 4/00**; **F21L 4/005**; **F21L 4/022**; **F21L 4/04**; **F21L 4/045**; **F21V 17/002**;  
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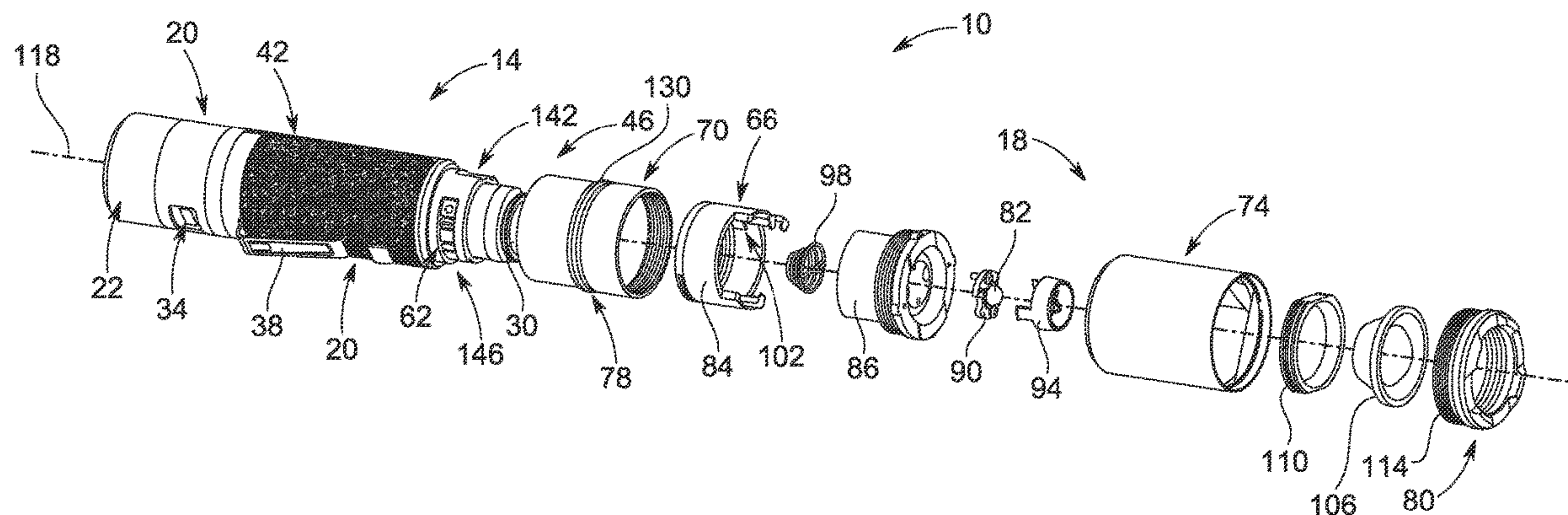
*Primary Examiner* — Y M. Quach Lee

(74) *Attorney, Agent, or Firm* — Michael Best & Friedrich LLP

(57) **ABSTRACT**

A flashlight includes a main body, a power source supported within the main body, a first electrical contact supported by the main body and electrically connected to the power source, and a head removably coupled to the main body. The head includes a light source, a lens, and a sliding focus mechanism axially moveable to adjust a distance between the light source and the lens. The flashlight further includes a second electrical contact supported by the head and electrically connected to the light source, a main body bayonet portion supporting the first electrical contact, and a head bayonet portion supporting the second electrical contact and engaged with the main body bayonet portion to electrically connect the first electrical contact with the second electrical contact.

**21 Claims, 7 Drawing Sheets**



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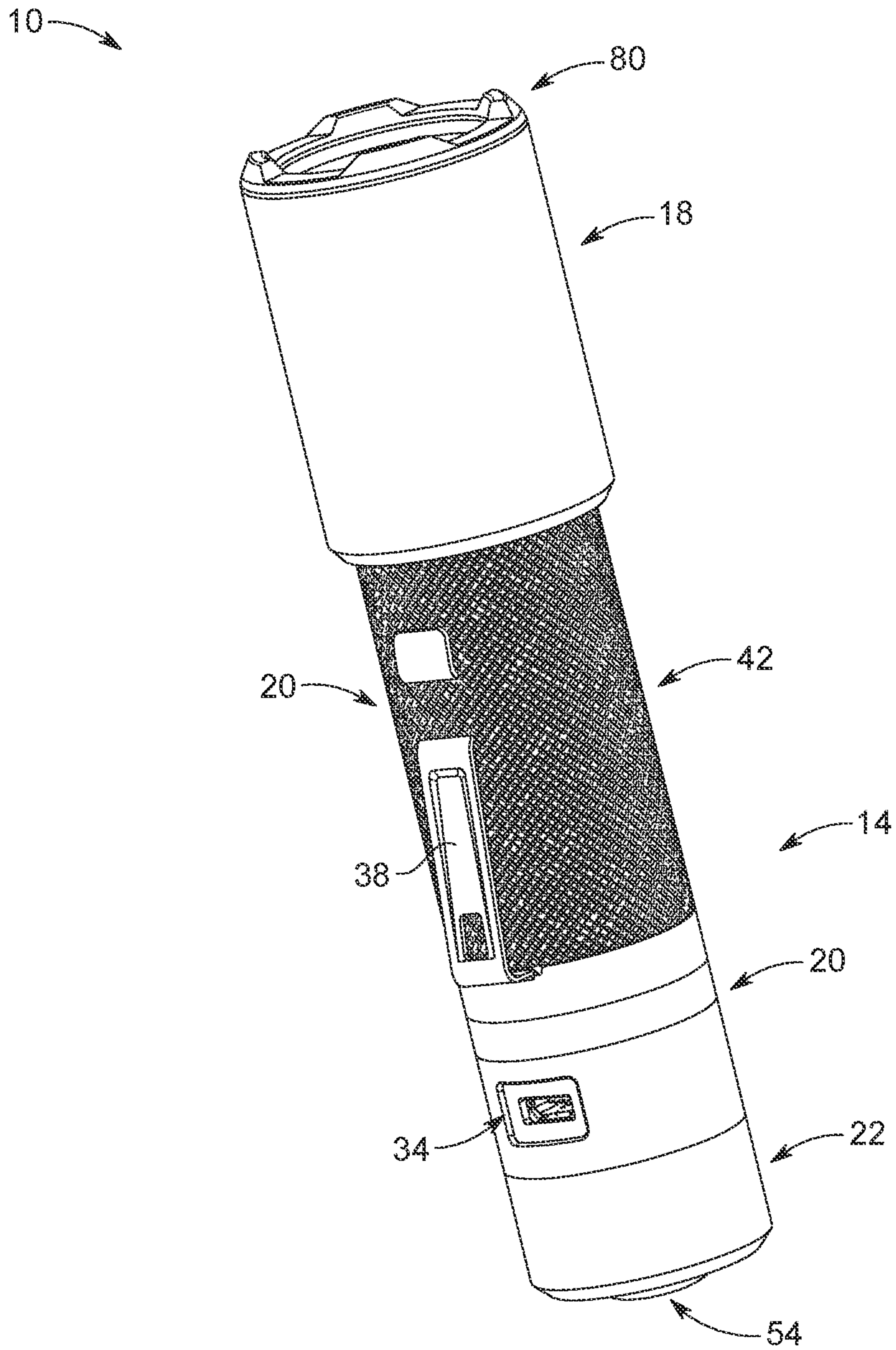


FIG. 1



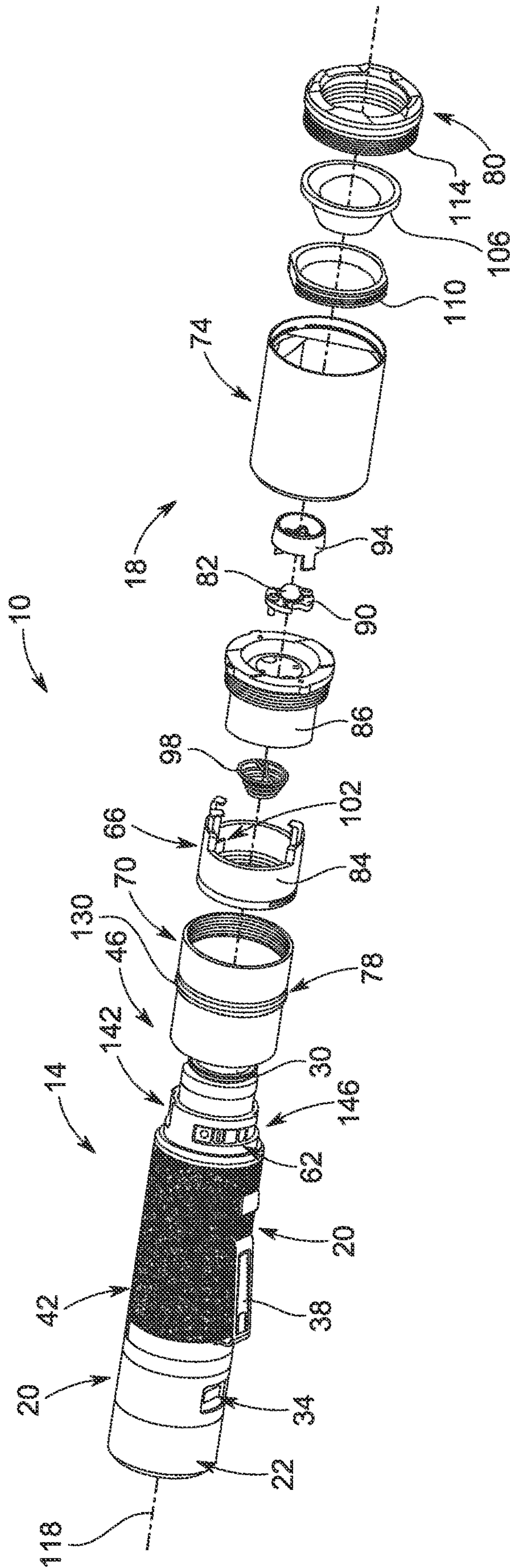


FIG. 2A

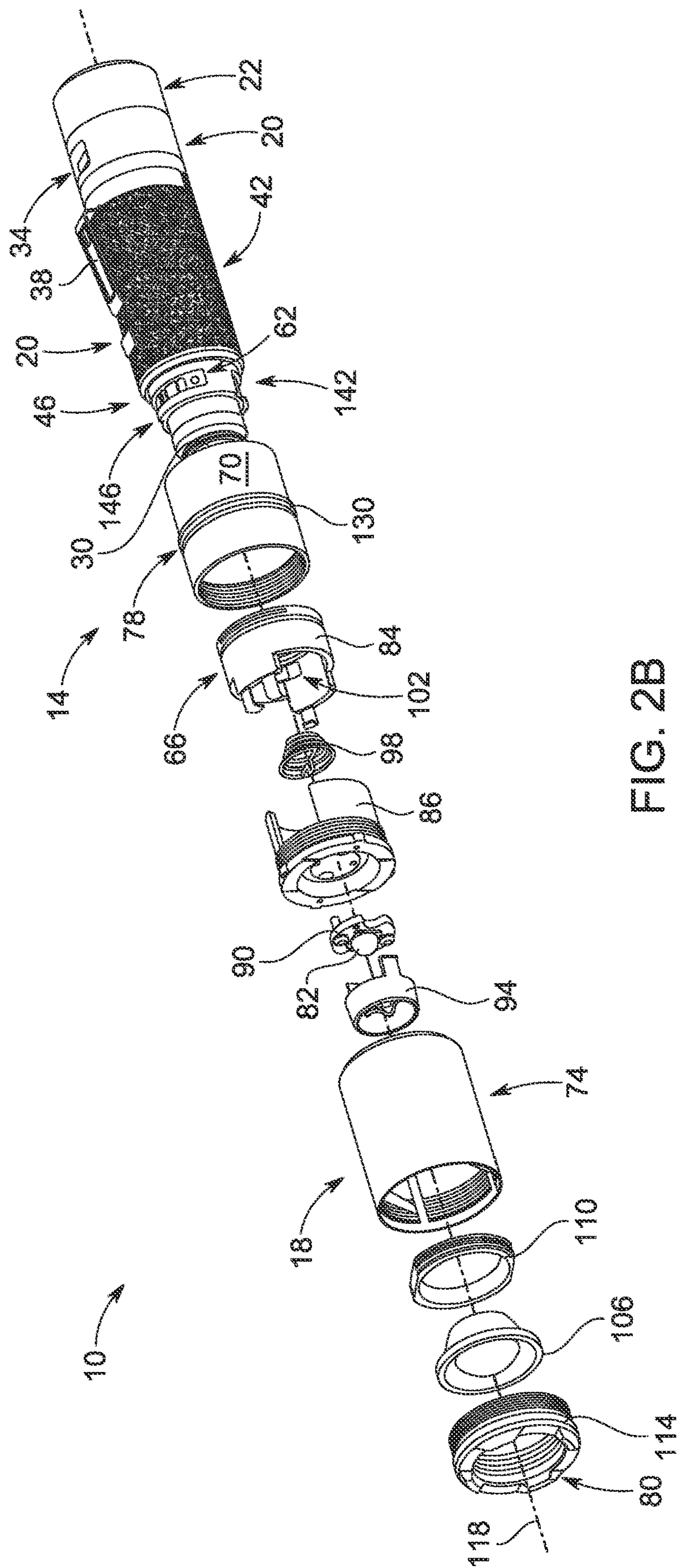


FIG. 2B



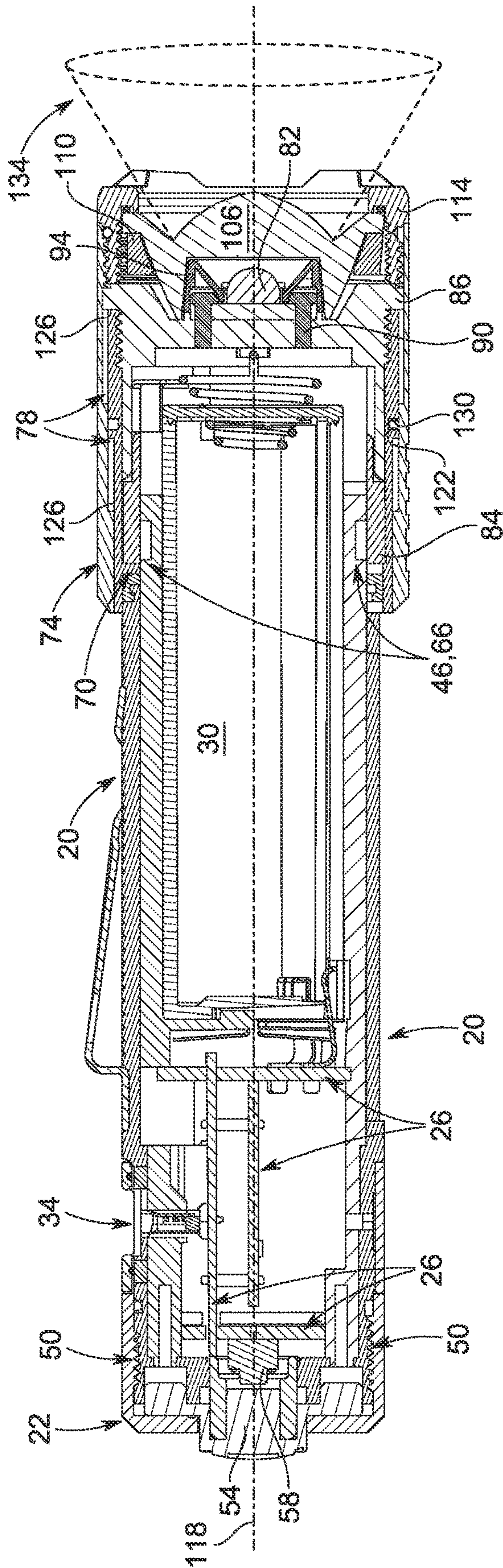


FIG. 3A

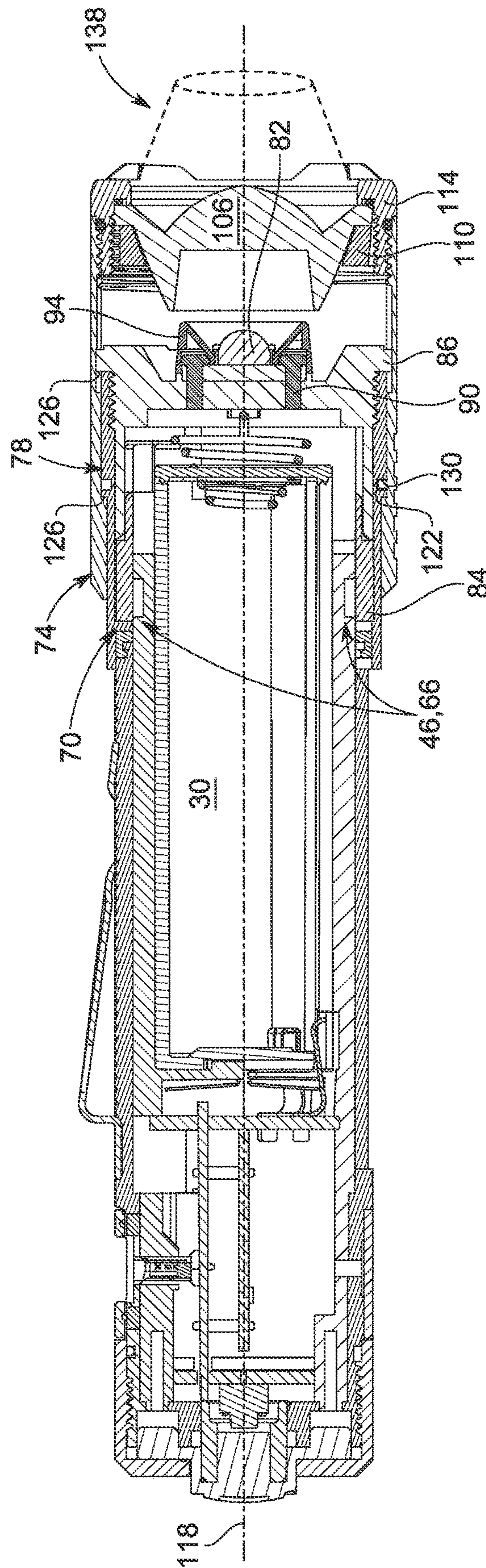


FIG. 3B



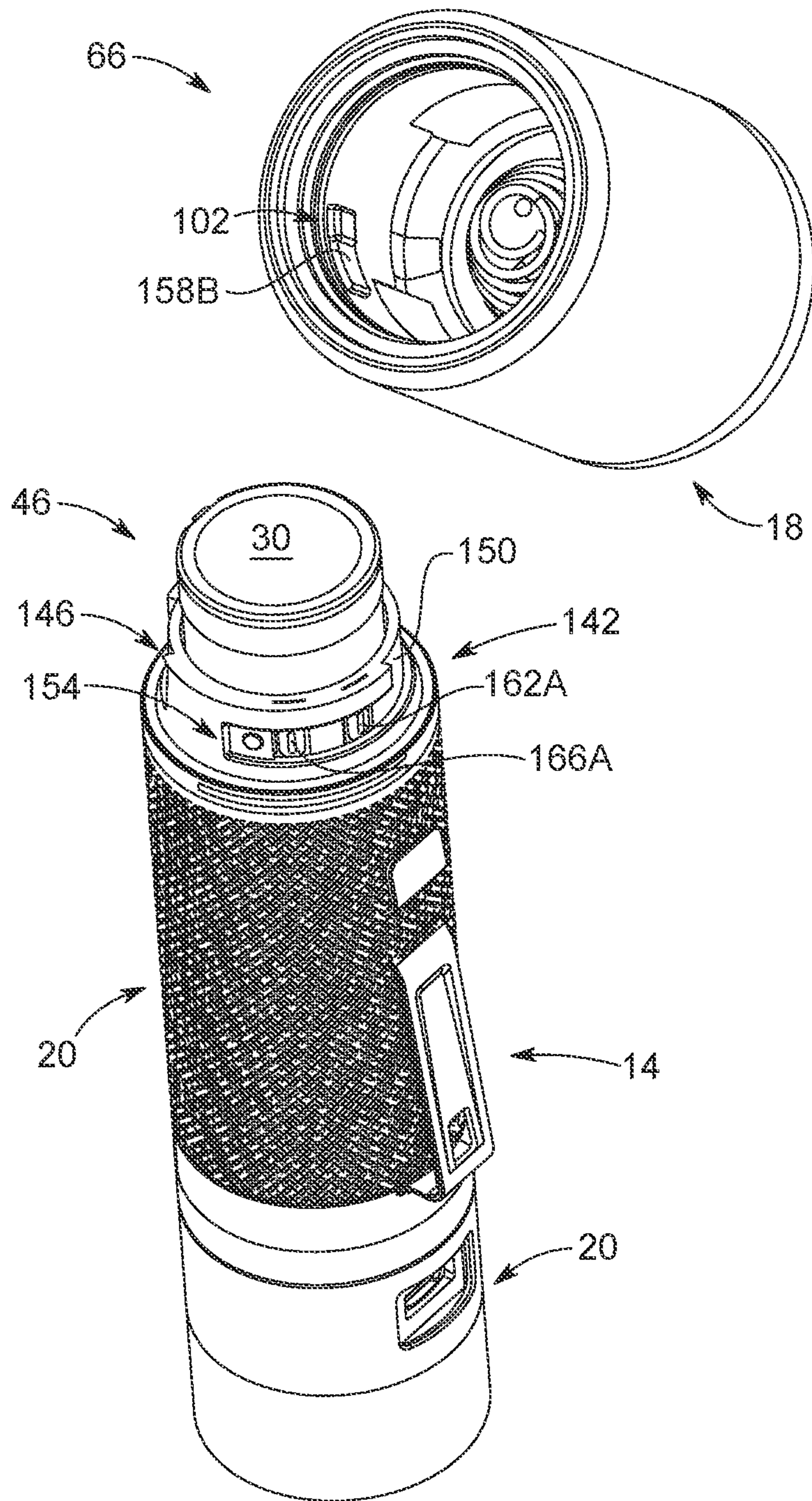


FIG. 4A



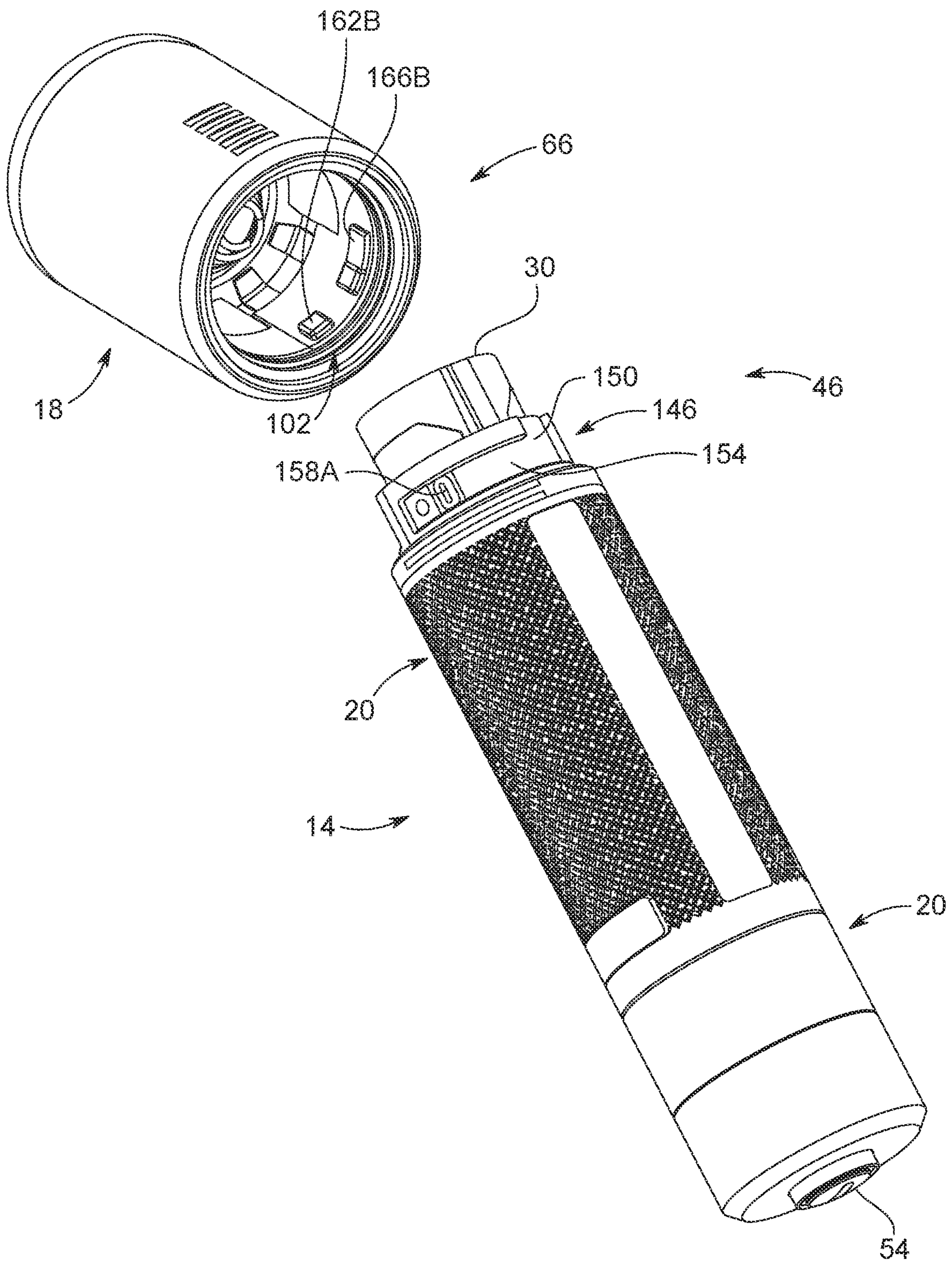


FIG. 4B



**1****FLASHLIGHT HAVING A REMOVABLE  
LIGHT HEAD****CROSS-REFERENCE TO RELATED  
APPLICATIONS**

This application claims priority to U.S. Provisional Patent Application No. 63/133,820 filed Jan. 5, 2021, the entire contents of which are incorporated herein by reference.

**FIELD**

The present disclosure relates to a lighting apparatus, such as a flashlight. More particularly, the present disclosure relates to a flashlight with a removable light head.

**BACKGROUND**

Typical flashlight heads house at least one bulb or LED. Generally, the bulb/LED is irremovably attached to a power source, which is often stored in a main body or handle part of the flashlight.

**SUMMARY**

In one embodiment, the invention provides a flashlight including a main body, a power source supported within the main body, a light head removably coupled to the main body. The light head includes a light source selectively powered by the power source, a lens, and a sliding focus mechanism that is linearly slidable along an axial direction to adjust a distance between the light source and the lens. The light source is electrically connected with the power source while the light head is coupled to the main body.

In another embodiment, the invention provides a flashlight including a main body including a main body connection portion and an end cap, a power source supported within the main body between the end cap and the main body connection portion, a first electrical contact supported in the main body connection portion and electrically connected to the power source, a light head including a light source and a light head connection portion, and a second electrical contact supported in the light head connection portion and electrically connected to the light source. The light head is rotatable and axially slidable along an axial direction relative to the main body to selectively remove the light head from the main body and electrically disconnect the power source from the light source.

In yet another embodiment, the invention provides a flashlight including a main body, a power source supported within the main body, a first electrical contact supported by the main body and electrically connected to the power source, a head removably coupled to the main body, the head including a light source, a lens, and a sliding focus mechanism axially moveable to adjust a distance between the light source and the lens, a second electrical contact supported by the head and electrically connected to the light source, a main body bayonet portion supporting the first electrical contact, and a head bayonet portion supporting the second electrical contact and engaged with the main body bayonet portion to electrically connect the first electrical contact with the second electrical contact.

Other aspects of the disclosure will become apparent by consideration of the detailed description and accompanying drawings.

**BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is a perspective view of a flashlight.

FIG. 2A is an exploded view of the flashlight of FIG. 1.

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FIG. 2B is another exploded view flashlight of FIG. 1.

FIG. 3A is a cross-sectional view of the flashlight taken along line 3-3 of FIG. 1 to show a sliding focus mechanism in a first position.

FIG. 3B is a cross-sectional view of the flashlight taken along line 3-3 of FIG. 1 to show the sliding focus mechanism in a second position.

FIG. 4A is a perspective view of the flashlight of FIG. 1 with a light head removed to show a connection portion.

FIG. 4B is another perspective view of the flashlight of FIG. 1 with the light head removed to show the connection portion.

Before any embodiments of the disclosure are explained in detail, it is to be understood that the disclosure is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the following drawings. The disclosure is capable of other embodiments and of being practiced or of being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting.

Use of “including” and “comprising” and variations thereof as used herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items. Use of “consisting of” and variations thereof as used herein is meant to encompass only the items listed thereafter and equivalents thereof. Unless specified or limited otherwise, the terms “mounted,” “connected,” “supported,” and “coupled” and variations thereof are used broadly and encompass both direct and indirect mountings, connections, supports, and couplings.

**DETAILED DESCRIPTION**

As shown in FIGS. 1-2B, a flashlight 10 includes a main body 14 and a light head 18 selectively attachable to the main body 14. The main body 14 is configured to be grasped by a user and may also be referred to as a handle. The main body 14 includes a housing 20, an end cap 22 coupled to a first end of the housing 20, one or more circuit boards 26 (e.g., main control board (MCB), power control board (PCB), encoder board/chip, etc.) (FIG. 3A) positioned within the housing 20, and a power source 30 positioned within the housing 20. In the illustrated embodiment, the power source 30 is a removable/rechargeable battery 30. The illustrated main body 14 also includes a battery charging receptacle 34 and a clip 38 supported by the housing 20. The housing 20 defines a grip 42, such as a knurled or otherwise contoured surface. In the illustrated embodiment, the main body 14 further includes a main body portion 46 to selectively couple the light head 18 to the main body 14.

With reference to FIGS. 2A-3B, the end cap 22 is attached to the main body 14 via a threaded connection 50 between the end cap 22 and the main body 14. In other embodiments, the end cap 22 may be attached to the main body 14 by another attachment mechanisms such as a fastener. In yet another embodiment, the end cap 22 may be integrally formed on the main body 14. As best shown in FIGS. 3A and 3B, the end cap 22 supports a physical switch 54. In the illustrated embodiment, the switch 54 is a push-button. In other embodiments, the switch 54 could alternatively be a pressure pad, a rotatable selector switch, a toggle, a slider, or the like. In some embodiments, the switch 54 may be located elsewhere on the main body 14 or may be located on the light head 18.



The switch **54** is moveable (e.g., depressible) by a user to control operation of the flashlight **10** (e.g., ON/OFF). In some embodiments, the switch **54** may also control a mode (e.g., high, medium, low, flashing, etc.) of the flashlight **10**. A switch contact **58** is supported within the main body **14** adjacent the switch **54**. The switch contact **58** is in electrical communication with at least one of the circuit boards **26**. The switch contact **58** is configured to read a condition of the switch **54** and communicate the read condition to one of the boards **26**. Although the switch **54** and the circuit boards **26** are adjacent one another in the illustrated embodiment, the switch **54** and the circuit boards **26** could be positioned in different locations on or in the flashlight **10**, main body **14**, and/or end cap **22**.

The circuit boards **26** are also utilized to control charging of the battery **30** through the battery charging receptacle **34**. The battery charging receptacle **34** may be configured to receive a connector (e.g., USB, micro USB, USB-C, etc.) suitable for supplying power to the battery **30**, which in turn supplies power to the flashlight **10**. In other embodiments, the battery **30** is a removable and disposable battery. In general, electrical components (e.g., the switch contact **58**, the charging receptacle **34**, etc.) supported on or in the main body **14** are always in electrical communication with the boards **26** and battery **30**. The battery **30** also supplies power to electrical contacts **62** of the main body connection portion **46**.

With continued reference to FIGS. 2A-3A, the light head **18** includes a head connection portion **66**, a base **70**, a focusing head **74**, and a sliding mechanism **78**. The illustrated light head **18** may also include one or more projections **80** that extend from the light head **18**. As will be described in greater detail below with reference to FIGS. 4A and 4B, the main body connection portion **46** and head connection portion **66** are complementary to one another and are configured to selectively electrically and mechanically connect the light head **18** to the main body **14**.

With specific reference to FIGS. 2A and 2B, the light head **18** houses a light source **82** supported within the base **70** on a support **90** and configured to generate light. In the illustrated embodiment, the light source **82** is a light emitting diode (LED). In some embodiments, the light source **82** may include an array of LEDs. In other embodiments, the light head **18** may include other suitable light sources. In the illustrated embodiment, the base **70** further includes a conductive substrate **84** and an insert **86**. The substrate **84** and insert **86** are fastened within the base **70**. In other embodiments, either or both of the substrate **84** and the insert **86** may be formed on the base **70**. The base **70** further supports a reflector cup or bowl **94** surrounding the light source **82**, a retainer **98**, and electrical contacts **102** positioned within the head connection portion **66** (FIGS. 4A and 4B). The retainer **98**, which may be referred to as a spring retainer or a spring, is positioned on the base **70** and asserts a spring force onto the battery **30** while the light head **18** and the main body **14** are connected together. In other embodiments, the spring **98** could be positioned on the main body **14**, directly supported on the battery **30**, bearing against the battery **30**, or disposed on another part of the flashlight **10** in order to maintain a tight fit between the light head **18** and the main housing **14** when connected. In still other embodiments, the spring **98** could be a rigid member for maintaining a tight fit between the connected light head **18** and the main housing **14**.

The focusing head **74** includes a lens **106** supported in the focusing head **74** by a lens mount **110** and a lens retainer **114**. The lens mount **110** is threaded into the focusing head

**74** on one end of the lens **106**. The lens retainer **114** is threaded into the focusing head **74** on another end of the lens **106**, opposite the lens mount **110**, such that the lens **106** is retained within the focusing head **74** between the mount **110** and the retainer **114**. The arrangement of the mount **110** and the retainer **114** eliminates the need to form threads directly on the lens **106**. In another embodiment, the lens **106** may be formed on the focusing head **74** or even over molded within the focusing head **74**. The projections **80** may be formed on or attached to the focusing head **74** to protect the lens **106**. Heat generated during operation of the flashlight **10** may also be dissipated into the projections **80** to reduce an operating temperature within the flashlight **10**.

Referring now to FIGS. 3A and 3B, the focusing head **74** is moveable relative to the base **70** via the sliding mechanism **78** to alter a distance between the LED **82** and the lens **106**. In the illustrated embodiment, the focusing head **74** linearly slides in an axial direction **118** that is parallel to a longitudinal axis of the flashlight **10**. The sliding mechanism **78** includes a groove **122** formed in the base **70** and stops **126** formed on the focusing head **74** and the base **70**. The groove **122** is configured to receive a gasket **130** (e.g., an O-ring, an X-ring, etc.) positioned between the focusing head **74** and the base **70**. In the illustrated embodiment, the gasket **130** is positioned in the groove **122** formed on an outer surface of the base **70**. In another embodiment, the groove **122** is formed on an inner surface of the focusing head **74**.

The gasket **130** applies resistance between the focusing head **74** and the base **70** to resist movement between the focusing head **74** and the base **70**. Enough resistance is applied by the gasket **130** to allow a user to move (e.g., linearly slide) the focusing head **74** to a desired position. The focusing head **74** and the base **70** are shaped such that the stops **126** limit the movement of the focusing head **74** relative to the base **70**. The stops **126** allow the focusing head **74** to be moved between a first position (FIG. 3A) and second position (FIG. 3B).

In the first position, the focusing head **74** is at a minimum limit, and light emitted by the light source **82** shines through the lens **106** with a relatively wide pattern **134**. In the second position, the focusing head **74** is at a maximum limit, and light emitted by the light source **82** shines through the lens **106** with a relatively narrow or spotlight pattern **138**. Stated another way, an area of light emitted by the light source **82** narrows as the lens **106** is moved away from the light source **82**. While the stops **126** inhibit the focusing head **74** from moving beyond the maximum and minimum limit, the gasket **130** allows the focusing head **74** to moved smoothly between the limits.

Referring now to FIGS. 4A and 4B, the complementary main body and head connection portions **46**, **66** will be described in greater detail. The illustrated connection portions **46**, **66** form a bayonet-style connection between the main body **14** and the light head **18**. As such, the main body connection portion **46** may be referred to as a main body bayonet portion **46**, and the head connection portion **66** may be referred to as a head bayonet portion **66**. The connection portions **46**, **66** allow the light head **18** to be disconnected and physically separated from the main body **14** without tools or otherwise disassembling the flashlight **10**. Separating the light head **18** from the main body **14** allows a user to access and remove or replace the battery **30** such that battery **30** may be accessible in the main body **14** while the light head **18** is separated from the main body **14**.

The illustrated main body connection portion **46** includes a first bayonet channel **142** and a second bayonet channel



146. Each of the first and second bayonet channels 142, 146 have a linear groove 150 and a radial groove 154 continuous with the linear groove 150. The linear groove 150 is an axial groove that that extends in the axial direction 118, while the radial groove 154 extends radially around a portion of the handle housing 14. The radial groove 154 supports the electrical contacts 62, which may consist of a first positive terminal 158A (e.g., LED+), a first negative terminal 162A (e.g., LED-), and a first auxiliary terminal 166A (e.g., ground, negative-temperature-coefficient thermistor, etc.).

The illustrated head connection portion 66 includes the electrical contacts 102, which consist of a second positive terminal 158B (e.g., LED+), a second negative terminal 162B (e.g., LED-), and a second auxiliary terminal 166B (e.g., ground, negative-temperature-coefficient thermistor, etc.). In the illustrated embodiment, the head connection portion 66 and the terminals 158B, 162B, 166B are supported on the substrate 84. The illustrated terminals 158B, 162B, 166B are conductor pads that project radially inward from the substrate 84. The substrate 84 is configured to electrically connect the terminals 158B, 162B, 166B to the light source 82. In other embodiments, the head connection portion 66 and terminals 158B, 162B, 166B may be provided on another part of the base 70.

As illustrated in the FIGS. 4A and 4B, the second positive terminal 158B is arranged to be received in one of the first and second bayonet channels 142, 146, while the second negative terminal 162B is arranged to be received in the other of the first and second bayonet channels 142, 146. In other embodiments, the second positive terminal 158B, the second negative terminal 162B, and the second auxiliary terminal 166B may be arranged in the same channel. In yet another embodiment, the terminals 158B, 162B, 166B may be arranged in any arrangement or combination within the channels 142, 146.

The electrical contacts 102 are configured to be physically received in the bayonet channels 142, 146 and to electrically interface with the electrical contacts 62. More specially, the electrical contacts 102 are initially received in the linear groove 150 and do not make electrical connection with the electrical contacts 62. Following adequate axial movement, the electrical contacts 102 are moved radially within the radial groove 154 into electrical connection with the electrical contacts 62. Concurrently, the electrical contacts 102 are moved into mechanical connection with the electrical contacts 62 through a snap fit. Stated another way, the electrical contacts 102 may be moved over the electrical contacts 62 by overcoming (e.g., temporarily overcoming) an outward biasing or snapping force to retain the LED head 18 on the handle housing 14.

As described above, the battery 30 supplies power to the electrical contacts 62 within the main body connection portion 46. When the light head 18, or another electrically powered device or head, is sufficiently moved axially and radially to be attached to the main body 14, electrical contacts 102 on the light head 18 are moved into contact with the electrical contacts 62 on the main body 14 to complete an electrical circuit from the battery 30, thereby powering the light head 18. For example, a power circuit between the battery 30, the electrical contacts 62 on the main body 14, the electrical contacts 102 on the light head 18, and the light source 82 is completed after sufficient axial and radial movement of the light head 18 relative the main body 14.

Described another way, the flashlight 10 includes the main body 14, the light head 18, and a bayonet mount mechanism including complimentary male and female parts (i.e., bayo-

net portions 46, 66). Either of the male and female portions include conductors (i.e., contacts 62 and pads 102) configured to electrically interface with one another to selectively power the light head 18 and mechanically couple the main body 14 and the light head 18 to one another. In the illustrated embodiment, the light head 18 includes the male bayonet portion in the form of the head connection portion 66 and the electrical contacts 102, while the main body 14 includes the female bayonet portion in the form of the main body connection portion 46, the channels 142, 146, and the electrical contacts 62. In other embodiments, the male and female portions are provided on different parts of the flashlight 10 such that the present invention is not limited to the male and female arrangement described above. For example, in another embodiment, the main body 14 includes the male portion and the electrical contacts 102, while the light head 18 includes the female portion and the electrical contacts 62.

In operation of the flashlight 10, while electricity is being carried through the electrical contacts 62 and the electrical contacts 102, a user may operate the switch 54 to selectively control a state of the light source 82 (e.g., ON/OFF). In the ON state of the light source 82, a full circuit, which includes the circuit boards 26, the battery 30, the switch contacts 58, the electrical contacts 62, the light source 82, the substrate 84, and/or the electrical contacts 102, is completed and the light source 82 is powered by a PWM signal to emit a pattern or area of light.

In the OFF state of the light source 82, the full circuit described above is still completed, but no PWM signal is sent to power the light source 82. While in either the ON or OFF state, the user may selectively break the full circuit by rotating the light head 18 relative the main body 14 a sufficient amount to disconnect the electrical contacts 62 from the electrical contacts 102. The user may further move the light head 18 axially relative the main body 14 to completely remove the light head 18 from the main body 14.

In order to re-complete the full circuit, the user may axially insert the electrical contacts 102 into the bayonet channels 142, 146 and rotate the light head 18 relative the main body 14 to connect the electrical contacts 102 with the electrical contacts 62. In this manner, the user effectively re-connects the light head 18 to the main body 14.

The embodiment(s) described above and illustrated in the figures are presented by way of example only and are not intended as a limitation upon the concepts and principles of the present disclosure. As such, it will be appreciated that variations and modifications to the elements and their configuration and/or arrangement exist within the spirit and scope of one or more independent aspects as described.

What is claimed is:

1. A flashlight comprising:

a main body;

a power source supported within the main body; and

a light head removably coupled to the main body, the light head including

a light source selectively powered by the power source, a lens, and

a sliding focus mechanism that is linearly slidable along an axial direction to adjust a distance between the light source and the lens,

wherein the light source is electrically connected with the power source while the light head is coupled to the main body,

wherein the light head is removably coupled to the main body by a bayonet-style connection, and wherein a first connection portion of the bayonet-style connection is formed on the light head and a second connection



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portion complementary to the first connection portion is formed on the main body, and

wherein the first and second connection portions each include electrical contacts configured to electrically connect the power source and the light source.

2. The flashlight of claim 1, wherein a portion of the light head other than the first connection portion selectively bears against the power source while the light head is coupled to the main body, and wherein the power source is accessible in the main body while the light head is separated from the main body.

3. The flashlight of claim 1, wherein the light head further includes

a base including a light source support, and

a focusing head portion moveable relative the base via the sliding focus mechanism, the sliding focus mechanism having stops limiting axial relative movement between the base and the focusing head portion.

4. The flashlight of claim 3, wherein the light head further includes a gasket positioned between the focusing head and the base to resist movement therebetween.

5. The flashlight of claim 3, wherein the focusing head portion includes a lens mount and a lens retainer threadably coupled to the focusing head portion on opposing ends of the lens such that the lens is retained within the focusing head portion between the lens mount and the lens retainer.

6. The flashlight of claim 5, wherein the base further includes

a substrate,

an insert, the insert and the substrate each threadably fastened within the base, one or more of the substrate and the insert being electrically conductive, and

a reflector surrounding the light source.

7. The flashlight of claim 6, wherein the lens, the lens mount, and the lens retainer are axially moveable via the sliding mechanism relative the substrate, the insert, the light source, and the reflector between the stops to selectively generate a relatively wide or narrow light pattern, the lens surrounding the reflector and the light source to generate the relatively wide light pattern.

8. A flashlight comprising:

a main body including a main body connection portion and an end cap;

a power source supported within the main body between the end cap and the main body connection portion;

a first electrical contact supported in the main body connection portion and electrically connected to the power source;

a light head including a light source and a light head connection portion; and

a second electrical contact supported in the light head connection portion and electrically connected to the light source, the light head being rotatable and axially slidable along an axial direction relative to the main body to selectively remove the light head from the main body and electrically disconnect the power source from the light source.

9. The flashlight of claim 8, wherein the main body connection portion includes a bayonet channel, and wherein the first electrical contact is positioned within the bayonet channel.

10. The flashlight of claim 9, wherein the second electrical contact is slidably received in the bayonet channel and rotatable with the light head into connection with the first electrical contact.

11. The flashlight of claim 10, wherein the bayonet channel includes a linear groove portion and a radial groove

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portion continuous with the linear groove portion, the linear groove portion extending axially along the axial direction and the radial groove portion extending from the linear groove portion and radially around a portion of the main body.

12. The flashlight of claim 11, wherein the first electrical contact is positioned within the radial groove portion of the bayonet channel.

13. The flashlight of claim 12, wherein the second electrical contact connects to the first electrical contact only in the radial groove portion.

14. The flashlight of claim 10, wherein the first electrical contact generates a biasing force radially outwardly, and wherein the second electrical contact is rotatable relative the first electrical contact to temporarily overcome the biasing force and snap the second electrical contact into electrical and mechanical connection with the first electrical contact.

15. A flashlight comprising:

a main body;

a power source supported within the main body;

a first electrical contact supported by the main body and electrically connected to the power source;

a head removably coupled to the main body, the head including a light source, a lens, and a sliding focus mechanism axially moveable to adjust a distance between the light source and the lens;

a second electrical contact supported by the head and electrically connected to the light source;

a main body bayonet portion supporting the first electrical contact; and

a head bayonet portion supporting the second electrical contact and engaged with the main body bayonet portion to electrically connect the first electrical contact with the second electrical contact.

16. The flashlight of claim 15, wherein the main body bayonet portion includes a bayonet channel, and wherein the first electrical contact is positioned within the bayonet channel.

17. The flashlight of claim 16, wherein the bayonet channel is first bayonet channel positioned on a first side of the main body, and wherein the main body bayonet portion includes a second bayonet channel positioned on a second side of the main body opposite the first side.

18. The flashlight of claim 17, further comprising

a third electrical contact supported by the main body and electrically connected to the power source; and

a fourth electrical contact supported by the head and electrically connected to the light source,

wherein the second bayonet channel includes the third electrical contact, and

wherein the head is rotatable relative the main body to electrically connect the first electrical contact with the second electrical contact in the first bayonet channel and to electrically connect the third electrical contact with the fourth electrical contact in the second bayonet channel.

19. A flashlight comprising:

a main body;

a power source supported within the main body; and

a light head removably coupled to the main body, the light head including

a light source selectively powered by the power source, a lens, and

a sliding focus mechanism that is linearly slidable along an axial direction to adjust a distance between the light source and the lens,

wherein the light source is electrically connected with the power source while the light head is coupled to the main body,

wherein the light head further includes

a base including a light source support, and 5

a focusing head portion moveable relative the base via the sliding focus mechanism, the sliding focus mechanism having stops limiting axial relative movement

between the base and the focusing head portion, and 10

wherein the focusing head portion includes a lens mount and a lens retainer threadably coupled to the focusing head portion on opposing ends of the lens such that the lens is retained within the focusing head portion between the lens mount and the lens retainer. 15

**20.** The flashlight of claim **19**, wherein the base further includes

a substrate,

an insert, the insert and the substrate each threadably fastened within the base, one or more of the substrate 20 and the insert being electrically conductive, and

a reflector surrounding the light source.

**21.** The flashlight of claim **20**, wherein the lens, the lens mount, and the lens retainer are axially moveable via the sliding mechanism relative the substrate, the insert, the light 25 source, and the reflector between the stops to selectively generate a relatively wide or narrow light pattern, the lens surrounding the reflector and the light source to generate the relatively wide light pattern.

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